Dichlorodiphenyltrichloroethane

CAS No. 50-29-3 for techinal grade

General Information

Dichlorodiphenyltrichloroethane (DDT) is an insecticide that was used initially in the 1940s by the military against mosquitoes that carried vector-borne diseases (e.g., malaria). The U.S. EPA banned use of DDT in the United States in 1973, and it is no longer being produced in this country. However, DDT still is being used and produced in limited quantities in other countries. Commercially available DDT (technical grade) contains two chemical forms of DDT: p,p'- DDT and o,p'-DDT.

Food is the primary pathway of DDT exposure for the general population. Diets that contain large amounts of fish from the Great Lakes will increase a person's exposure to DDT. The estimated food intake of DDT in the United States has decreased since the 1950s (Walker et al., 1954; Durham et al., 1965; Duggan and Cornelius-sen, 1972). However, food imported into the United States from other countries that stll use DDT may have DDT contamination. Food from tropical regions may contain more DDT because of its greater use in these regions.

A major metabolite of DDT is 1,1'-(2,2-dichloro-ethenylidene)-bis[4-chlorobenzene] (DDE), which can be produced in people or in the environment. DDE is more persistent than DDT in the environment and in people. The presence of DDT in the body reflects either a

Table 157. *p,p'*-DDT (lipid adjusted)

Geometric mean and selected percentiles of serum concentrations (nanograms/gram [ng/g] of lipid or parts-per-billion on a lipid weight basis) for the U.S. population aged 12 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. Interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 12 and older	*	< LOD	< LOD	< LOD	< LOD	< LOD	27.0 (<LOD-34.0)	1679
Age group								
12-19 years	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	677
20 years and older	*	< LOD	< LOD	< LOD	< LOD	< LOD	29.4 (22.2-37.3)	1002
Gender								
Males	*	< LOD	< LOD	< LOD	< LOD	< LOD	24.3 (<LOD-34.1)	799
Females	*	< LOD	< LOD	< LOD	< LOD	< LOD	29.1 (22.5-34.0)	880
Race/ethnicity								
Mexican Americans	*	< LOD	< LOD	< LOD	< LOD	59.7 (28.9-150)	150 (63.4-493)	635
Non-Hispanic blacks	*	< LOD	< LOD	< LOD	< LOD	< LOD	25.7 (<LOD-63.9)	356
Non-Hispanic whites	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	564

< LOD means less than the limit of detection, which averaged 10.6 ng/g of lipid (SD 3.4, maximum value 20.7).

* Not calculated. Proportion of results below limit of detection was too high to provide a valid result.

relatively recent exposure or cumulative past exposure. A high DDT to DDE ratio may indicate recent exposure, and a low DDT to DDE ratio may indicate an exposure in the more distant past (Radomski et al., 1971).

The health effects associated with DDT after large accidental exposures or workplace exposures have been described (Hayes, 1976). Elevations of liver enzymes in serum have been observed in exposed workers. The toxic effects of DDT demonstrated in experimental animals include infertility (Jonsson et al., 1975), a decrease in the number of implanted ova (Lundberg, 1974), intrauterine growth retardation (Fabro et al., 1984), cancer (Cabral et al., 1982), neurologic developmental disorders (Eriksson et al., 1990) and fetal death (Clement and Okey, 1974). The association of DDT exposure and breast cancer has been studied but not clearly established (Lebel et al., 1998; Hoyer et al., 1998; Helzlsouer et al., 1999; Hunter et al., 1997). IARC classifies DDT (p,p'-DDT) as a possible human carcinogen; NTP considers that DDT is reasonably anticipated to be a human carcinogen; and the U.S. EPA has classified DDT as a probable human carcinogen.

Table 158. *p,p'*-DDE (lipid adjusted)

Geometric mean and selected percentiles of serum concentrations (nanograms/gram [ng/g] of lipid or parts-per-billion on a lipid weight basis) for the U.S. population aged 12 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. Interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 12 and older	260 (234-289)	74.2 (66.1-84.2)	114 (99.8-129)	226 (191-267)	538 (485-609)	1120 (991-1290)	1780 (1520-2230)	1964
Age group								
12-19 years	118 (101-137)	45.9 (34.9-56.6)	69.8 (59.2-80.4)	108 (90.6-132)	185 (141-233)	343 (255-479)	528 (364-644)	686
20 years and older	297 (267-330)	86.0 (75.2-96.7)	130 (115-150)	269 (229-303)	626 (538-697)	1250 (1100-1420)	1990 (1570-2510)	1278
Gender								
Males	249 (221-281)	77.6 (68.6-88.2)	119 (101-133)	222 (182-266)	489 (383-570)	985 (756-1130)	1350 (1190-1610)	937
Females	270 (241-302)	68.9 (55.1-82.5)	112 (96.0-129)	228 (191-286)	604 (516-697)	1320 (1100-1600)	2150 (1650-2750)	1027
Race/ethnicity								
Mexican Americans	674 (572-795)	154 (133-214)	300 (252-370)	623 (505-750)	1350 (1090-1660)	3090 (2100-4610)	4940 (3280-7810)	657
Non-Hispanic blacks	295 (253-344)	62.2 (56.9-80.5)	113 (98.3-128)	203 (164-253)	452 (392-571)	1340 (974-1910)	2160 (1470-4010)	416
Non-Hispanic whites	217 (193-244)	73.0 (63.2-82.2)	107 (94.5-127)	197 (175-238)	459 (372-513)	852 (693-1010)	1220 (1040-1410)	732

Interpreting Lipid-Adjusted Serum DDT and DDE Levels Reported in the Tables

The 95th percentile levels for p,p'-DDT and p,p'-DDE in this *Report* are about 15-fold and fivefold lower than levels found in 1976-1980 for a non-random subsample from NHANES II participants (Stehr-Green et al., 1989). These decreases in U.S. levels are consistent with the decreased use and manufacture of these chemicals. In 1976, the median lipid-adjusted serum levels of p,p'-DDT and p,p'-DDE were 141 ng/gram and 1183 ng/gram, respectively, in a population of 717 Danish females participating in a breast cancer study (Hoyer et al., 1998). For a control population from California during 1989-1990, p,p'-DDE was detected in 100% of the samples, and the median lipid-adjusted serum p,p'-DDE level was 1,358 ng/gram (Sturgeon et al., 1998), a level about fivefold greater than levels found in the 1999-2000 NHANES subsample. Local spraying with DDT can add greatly to body burdens. For example, a single application of DDT for malaria control increased serum DDT levels sevenfold in people tested 1 year after the application (Dua et al., 1996). For this 1999-2000 NHANES subsample, o,p'-DDT was detected in less than 1% of the population.

Geometric mean levels of the demographic groups were compared after adjustment for the covariates of race/ethnicity, age, and gender. The group aged 12-19 years had more than a twofold lower level of p,p'-DDE than the group aged 20 years and older. Similarly, in 1971, lower p,p'-DDE levels were found in children

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Geometric mean and selected percentiles of serum concentrations (nanograms/gram [ng/g] of lipid or parts-per-billion on a lipid weight basis) for the U.S. population aged 12 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. Interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 12 and older	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	1669
Age group								
12-19 years	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	667
20 years and older	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	1002
Gender								
Males	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	796
Females	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	873
Race/ethnicity								
Mexican Americans	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	632
Non-Hispanic blacks	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	354
Non-Hispanic whites	*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD	560

< LOD means less than the limit of detection, which averaged 10.6 ng/g of lipid (SD 3.3, maximum value 20.7).

* Not calculated. Proportion of results below limit of detection was too high to provide a valid result.

than in adults in Argentina (Radomski et al., 1971). In NHANES II participants, levels of p,p'-DDE were also shown to increase with age (Stehr-Green et al., 1989). There was no difference in p,p'-DDE levels between males and females documented in this *Report*. However, others have reported differences in levels of DDT or its metabolites between females and males (Waliszewski et al., 1996; Stehr-Green et al., 1989; Finklea et al., 1972; Sala et al., 1999).

In the NHANES 1999-2000 subsample, the adjusted geometric mean level of p,p'-DDE in Mexican Americans was 653 ng/gram, or about three times higher than in non-Hispanic whites and twofold higher than in non-Hispanic blacks. This higher level of p,p'-DDE in the Mexican-American population is similar to levels found in a 1997 study in which the majority of the control population was born in Mexico (Balluz et al., 2001). In 1998, Mexican-American migrant workers had a mean serum p,p'-DDE level that was threefold greater than the geometric mean level of Mexican Americans in this *Report* (Hernandez-Valero et al., 2001). Previous measurements of total DDT congeners in adipose tissue have demonstrated that African Americans had levels that were about twofold higher than levels in non-Hispanic whites (Kutz et al., 1977). It is unknown whether differences between ages or races/ethnicities represent differences in exposure, body-size relationships, or metabolism.